

State of Delaware  
Paramedic Standing Orders

# Pharmacology Manual



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## **GENERAL INFORMATION**

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All medications in this manual listed as IV may also be administered IO.

In the case of any dosing discrepancies in these manual vs the dose listed in the standing orders, the dose listed in the standing orders shall be considered correct.

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## **ANAPHYLACTIC PRECAUTIONS**

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### **Anaphylaxis:**

A generalized reaction occurring with dramatic suddenness (usually within a few minutes) after a patient has been exposed to some foreign material.

### **Cause:**

Any drug has the potential to precipitate anaphylaxis. Generally those administered intravenously or parenterally are more likely to result in life-threatening or fatal anaphylaxis than those ingested or applied to the skin or mucous membranes.

### **Clinical features:**

The patient with anaphylaxis may develop laryngeal edema and bronchospasm which cause respiratory distress and anoxia. The sooner the symptoms develop after the initiating stimulus the more intense the reaction. The symptoms include the following: generalized flush, urticaria, pruritus, anxiety, dyspnea, wheezing, choking, orthopnea, vomiting, cyanosis, paresthesias, shock, and loss of consciousness. Anoxia, shock, and death may occur within 5-10 minutes.

### **Prevention:**

- A. Know the patient's allergy history by asking the patient or family before giving a new medication.
- B. Know the precautions listed for each drug.

### **Treatment:**

- A. Stop the infusion of the medication but keep the IV line open.
- B. Maintain the airway.
- C. Be prepared to treat anaphylactic shock according to *The Statewide Standard Treatment Protocol*
- D. Call the medical command physician.
- E. After the emergency episode is over, calm the patient. Be certain that the patient has been informed of the allergy and that the allergy is documented on the report form. Verbally report the episode on arrival to hospital personnel and complete a variance report.

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## **INFILTRATION PRECAUTIONS**

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Before administering any IV medication or solution, the paramedic must check the IV site for patency and signs of infiltration and/or phlebitis. If infiltration occurs, stop the drug but do not remove the IV device. Contact the medical control physician immediately for orders.

### **FACTORS THAT INCREASE THE RISK OF INFILTRATION**

- A. Sclerotic vascular disease
- B. Venous obstruction in the arm (check for edema)
- C. Radiation treatment near the site of injection
- D. High drug concentration
- E. Limited choice for vein selection
- F. Multiple venipunctures
- G. Elderly or debilitated
- H. Superior vena cava syndrome
- I. Specific characteristics of the drug
- J. Uncooperative/irrational individual

### **SYMPTOMS OF AN INFILTRATION**

If pain, burning or stinging occurs at the injection site, evaluate the site for swelling, redness, and inflammation. The presence of a blood return or absence of edema does not negate the possibility of the infusate being spread outside the vein to surrounding tissue. Drug leakage may occur at the site of a previous vessel injury while the needle/catheter is still in the vein.

### **IRRITANTS (DEXTROSE, DIAZEPAM)**

- A. Definition:** An irritant is a medication that induces a local inflammatory reaction within the vein at the IV site.
- B. Guidelines for reducing irritation:** The local irritation may be reduced by decreasing the infusion rate, or by decreasing the drug concentration (increasing the diluent and/or increasing the intravenous solution flow rate while injecting the drug).

### **VESICANTS (i.e. DOPAMINE)**

- A. Definition:** A vesicant is a medication that induces blistering of tissues and may lead to tissue necrosis if the medication extravasates (infiltrates) from the vein into the surrounding tissue.
- B. Guidelines to reduce the danger of infiltration**  
Because the consequences may be severe to the patient, every effort to prevent infiltration must be implemented. The IV site must be observed frequently so that an infiltration can be identified early and further damage prevented.
- C. Treatment Guidelines for Vesicant Infiltration**
  - 1) **STOP INJECTION IMMEDIATELY:** If possible leave the IV device in place. It may be possible to aspirate the drug or an antidote may be given through the device.
  - 2) **CALL MEDICAL CONTROL PHYSICIAN FOR INSTRUCTIONS**
  - 3) Report the reaction on arrival to the hospital and note infiltration on report form.
  - 4) Apply cold compress if possible.

## **ADENOSINE (ADENOCARD®)**

### **Description**

Adenosine is an endogenous nucleoside formed from the breakdown of adenosine triphosphate (ATP); it is found in all body cells.

### **Pharmacology**

Adenosine slows conduction through the AV node, may interrupt reentry pathways through the AV node, and can restore sinus rhythm in episodes of paroxysmal supraventricular tachycardia (PSVT) and Wolff-Parkinson-White (WPW).

### **Indications**

Adenosine is indicated for conversion of narrow complex tachycardia at a rate exceeding 150bpm, PSVT and WPW. Adenosine does not convert atrial flutter, atrial fibrillation, or ventricular tachycardia.

### **Onset/Duration**

Onset of adenosine is within 30 seconds; its duration is 10 seconds due to rapid metabolism in the body.

### **Contraindications**

Adenosine is contraindicated in patients with second- or third- degree AV block (except for patients with an artificial pacemaker), sinus node disease (such as sick sinus syndrome), or a known hypersensitivity.

### **Warnings**

Adenosine may produce a short period of first-, second-, or third-degree AV block as well as transient or prolonged asystole. Adenosine should be used with caution in patients taking digoxin and/or verapamil as cases of ventricular fibrillation have been reported. Adenosine administration may produce new arrhythmias during conversion. Adenosine may cause bronchoconstriction and/or respiratory compromise in asthma or COPD patients.

### **Drug Interactions**

Adenosine should be used with caution in the presence of digoxin or verapamil due to the potential for additive or synergistic effects. Methylxanthines such as caffeine and theophylline antagonize the action of adenosine and may require higher doses. Dipyridamole (Persantine®, Aggrenox®) potentiates the effect of adenosine; reduced doses may be effective. Carbamazepine (Tegretol®) may increase the degree of heart block following adenosine administration.

### **Adverse Reactions**

Adenosine may result in facial flushing, diaphoresis, headache, chest pain, palpitations, hypotension, shortness of breath, lightheadedness, paresthesia, or nausea.

### **Dosage and Routes of Administration**

The recommended dose of adenosine for adults is 6 mg IV rapidly (followed by a saline flush) with second and third doses of 12 mg if needed, as per the stable and unstable tachycardia protocol. Half the dose of Amiodarone for patients taking Persantine.

**NOTE:** *The use of adenosine in children requires an order from medical control.* If the rhythm is a narrow complex tachycardia (SVT) at a rate exceeding 180 in children > 1 year old or 220 in infants less than 1, administer adenosine (Adenocard) 0.1mg/kg IV max dose 6mg. May repeat at 0.2mg/kg IV max dose of 12mg

## **ALBUTEROL SULFATE (PROVENTIL<sup>®</sup>, VENTOLIN<sup>®</sup>)**

### **Description**

Albuterol sulfate is the racemic form of albuterol, a relatively selective beta<sub>2</sub>-adrenergic bronchodilator.

### **Pharmacology**

The primary action of beta-adrenergic drugs, including albuterol, is to stimulate adenylyl cyclase, the enzyme which catalyzes the formation of cyclic AMP to mediate cellular responses. Increased cyclic AMP levels are associated with relaxation of bronchial smooth muscle.

### **Indications**

Albuterol sulfate is indicated for the relief of bronchospasm.

### **Onset/Duration**

The onset of albuterol occurs within 5 – 15 minutes; its duration is 3 to 6 hours.

### **Contraindications**

Albuterol sulfate is contraindicated in patients with tachycardic dysrhythmias (rate greater than 150 BPM) or a known hypersensitivity to albuterol or any of its components.

### **Warnings**

The use of beta-adrenergic agonist bronchodilators alone may not adequately control asthma; consider corticosteroids. Like other beta agonists, albuterol may cause a significant cardiovascular effect (increased pulse rate or blood pressure, ECG changes) as well as pronounced hypokalemia. Immediate hypersensitivity reactions may occur, such as urticaria, angioedema, and anaphylaxis. Large doses of albuterol have been reported to worsen preexisting diabetes and ketoacidosis.

### **Drug Interactions**

There are no known drug interactions with albuterol.

### **Adverse Reactions**

Side effects of albuterol administration may include tremors, dizziness, headache, nausea, nasal congestion, tachycardia, arrhythmias, hypertension, bronchospasm, and cough.

### **Dosage and Routes of Administration**

Adult acute respiratory distress protocol, the dosage is up to 5 mg via nebulizer, if wheezing continues you may administer a 2<sup>nd</sup> dose of up to 5mg of albuterol via nebulizer provided the patients heart rate remains less than 150 BPM. Consider the administration of 500 mcg of nebulized Atrovent.

By protocol, the pediatric dose is 2.5 mg via nebulizer (face mask or blow by for a child less than 2 years of age who is actively wheezing and has a history of asthma) initially, followed by an additional 2.5 mg in combination with Atrovent<sup>®</sup> for children over 2 years of age, you must contact medical control for additional doses in children under age two.

*For patients prescribed and taking levalbuterol, substitution of patient's own medication in place of albuterol is acceptable.*

## **AMIODARONE (CORDARONE®)**

### **Description**

Amiodarone is a class III antiarrhythmic but possesses characteristics of all four classes.

### **Pharmacology**

Amiodarone blocks sodium channels and exerts a noncompetitive antisympathetic action to decrease firing of the sinus node and slow conduction and prolong the refractory period in the AV node. Amiodarone also decreases cardiac workload and myocardial oxygen consumption through vasodilation.

### **Indications**

Amiodarone is indicated for the treatment and prophylaxis of ventricular fibrillation and hemodynamically unstable ventricular tachycardia.

### **Onset/Duration**

Onset of amiodarone is within minutes; its duration is 30 to 45 minutes.

### **Contraindications**

Amiodarone is contraindicated in patients with cardiogenic shock, marked sinus bradycardia, and second- or third-degree AV block (unless a pacemaker is available). It is also contraindicated in patients with a known hypersensitivity to amiodarone or its components.

### **Warnings**

Drug-related bradycardia or worsening of existing arrhythmias may also occur with amiodarone administration. Use in pregnancy should only occur if "the potential benefit to the mother justifies the risk to the fetus." (PDR 2001, pg. 3359)

### **Drug Interactions**

Amiodarone may significantly increase the effects of warfarin, digoxin, quinidine, procainamide, disopyramide (Norpace®), fentanyl, lidocaine, and cyclosporine. Cholestyramine and phenytoin (Dilantin®) may decrease levels of amiodarone in the body, whereas cimetidine may increase levels. Amiodarone use with beta- or calcium channel blockers may worsen hypotension or result in bradycardia.

### **Adverse Reactions**

Hypotension is the most common adverse effect. Other adverse effects include cardiac arrest, asystole, PEA, cardiogenic shock, CHF, bradycardia, v-tach, and AV block. Angioedema and anaphylaxis may also occur.

### **Dosage and Routes of Administration**

The adult dosage of amiodarone by protocol (VF/pulseless VT), is 300 mg bolus IV, with a repeat dose of 150 mg after 10 minutes. With return of spontaneous circulation, 150 mg of amiodarone may be infused via IV over 10 minutes.

The pediatric dosage of amiodarone by protocol is 5 mg/kg of amiodarone bolus IV.. With a return of spontaneous circulation administer 5mg/kg of amiodarone infused over 20 minutes. Total of all doses not to exceed 450 mg.

## **AMYL NITRATE**

### **Description**

Antidote for cyanide poisoning, coronary vasodilator.

### **Pharmacology**

In cyanide toxicity, nitrate ions oxidize hemoglobin (converts hemoglobin (Fe 2+) to form methemoglobin (Fe 3+), which binds with cyanide and assists in cyanide elimination. Also causes coronary vasodilatation.

### **Indications**

Used initially in management of cyanide, cyanogenic or sulfide toxicity.

### **Onset/Duration**

Onset is within 30 seconds and last approximately 3-5 minutes.

### **Contraindications**

Hypersensitivity to nitrates, closed head injury (increased intracranial pressure). None when used in the management of acute cyanide toxicity. If IV established give sodium nitrite.

### **Warnings**

Amyl Nitrate vapors are extremely flammable, do not use near open flame or intense heat. Use in children has not been studied.

### **Drug Interactions**

May potentiate the effects of prescribed nitrates – profound hypotension may result.

### **Adverse Reactions**

Adverse reactions may include: headache, dizziness, weakness, orthostatic hypotension, tachycardia, and nausea/vomiting.

### **Dosage and Routes of Administration**

0.2-0.3 ml (one ampule) inhaled for 30 seconds of each minute until Sodium Nitrite IV solution is available. Change ampule every 3 minutes. This may be delivered via assisted ventilations if necessary.

## **ASPIRIN**

### **Description**

Aspirin is a potent inhibitor of platelet aggregation and prostaglandin synthesis.

### **Pharmacology**

Aspirin affects platelet aggregation by irreversibly inhibiting prostaglandin cyclo-oxygenase, lasting for the life of the platelet and preventing formation of the platelet aggregating factor thromboxane A2. At higher doses, aspirin is an effective anti-inflammatory medication.

### **Indications**

Aspirin is indicated for ischemic stroke, TIA, acute MI, prevention of MI, and angina, both stable and unstable.

### **Onset/Duration**

Aspirin has an onset of action in 1-2 hours, with a duration of 6 hours.

### **Contraindications**

Aspirin is contraindicated in patients with known allergies to Aspirin or NSAIDs and in patients with active GI ulceration or bleeding, hemophilia or other bleeding disorders, during pregnancy, and children under 2 years of age.

### **Warnings**

By inhibiting platelet function, aspirin may lead to an increase in bleeding for patients with bleeding disorders. Patients with peptic ulcer disease should avoid aspirin, as it may result in irritation and bleeding.

### **Drug Interactions**

Aspirin may diminish effects of ACE inhibitors by affecting the renin-angiotensin conversion pathway. Aspirin can interfere with warfarin, prolonging prothrombin and bleeding times. Aspirin can increase the risk of bleeding when combined with heparin and coumadin. Aspirin can decrease concentration of phenytoin and increase concentration of valproic acid. Beta blockers and diuretics may be less effective when administered with aspirin, due to decreased renal blood flow and retention of salt and fluid. Aspirin inhibits clearance of methotrexate, which may result in toxicity. Aspirin may increase effectiveness of oral hypoglycemics, resulting in hypoglycemia.

### **Adverse Reactions**

Adverse reactions may include anaphylaxis, bronchospasm, dysrhythmias, hypotension, tachycardia, agitation, cerebral edema, intracranial hemorrhage, dehydration, hyperkalemia, and renal failure.

### **Dosage and Routes of Administration**

In suspected AMI or ACS, the dose is 162 mg PO even if patient is pain free.

## **ATROPINE SULFATE**

### **Description**

Atropine is an anticholinergic and parasympatholytic.

### **Pharmacology**

Atropine accelerates heart rate and may restore cardiac rhythm in asystole.

### **Indications**

Atropine is indicated for hemodynamically compromising bradycardia, asystole/slow PEA, and organophosphate poisoning.

### **Onset/Duration**

Onset is rapid; duration is 2-6 hours.

### **Contraindications**

There are no contraindications for atropine in an emergency situation. For non-emergent use, tachycardia, myocardial ischemia, glaucoma, and known hypersensitivity are the only contraindications.

### **Warnings**

Ventricular fibrillation and tachycardia have occurred following intravenous administration of atropine. Atropine may induce tachycardia harmful to patients suffering acute myocardial ischemia or infarction due to increased myocardial oxygen demand. Doses less than 0.5 mg in an adult can induce paradoxical bradycardia and ventricular arrhythmias.

### **Drug Interactions**

Use with other anticholinergics may increase effects of vagal blockade. Atropine may be enhanced by antihistamines, procainamide, quinidine, and psychotropic medications.

### **Adverse Reactions**

Excessive doses of atropine can cause delirium, tachycardia, coma, flushed and hot skin, ataxia and blurred vision. Paradoxical bradycardia may result from doses less than 0.5 mg. Side effects may include palpitations, dysrhythmias, headache, dizziness, nausea and vomiting.

### **Dosage and Routes of Administration**

The adult dosage is 0.5 mg for bradycardia and 1 mg for cardiac arrest IV repeated every 3-5 minutes to a maximum of 3 mg or a heart rate greater than 60bpm, as in the hemodynamically compromising bradycardia and asystole/PEA protocols.

The pediatric dose is 0.02 mg/kg IV. Minimum pediatric dose of 0.1 mg IV. Maximum single dose is 0.5 mg IV.

Under the DFI protocol, for patients less than or equal to 12 years of age, administer 0.02 mg/kg atropine IV 3 minutes prior to succinylcholine.

If organophosphate poisoning is suspected, contact medical direction for dosages.

## **BUMETANIDE (BUMEX®)**

### **Description**

Bumetanide is a potent loop diuretic.

### **Pharmacology**

Bumetanide is both chemically and functionally similar to furosemide although it is more potent (1 mg bumetanide = 40 mg furosemide); however, bumetanide does not share any of furosemide's venous dilatory effects. Like furosemide, bumetanide acts on the loop of Henle by inhibiting passive reabsorption of sodium. Bumetanide can also increase renal flow by as much as 40%.

### **Indications**

Bumetanide is indicated for the management of acute pulmonary edema and congestive heart failure. Bumetanide can be used to treat patients who are allergic to furosemide.

### **Onset/Duration**

Onset of action occurs within 30-60 minutes; duration is 4 to 6 hours.

### **Contraindications**

Bumetanide is contraindicated for patients with a known hypersensitivity to the medication, an allergy to sulfa drugs, or dehydration. and for patients who are dehydrated. Bumetanide is also contraindicated for patients suffering from anuria, but can be used for patients with renal insufficiency.

### **Warnings**

Use for managing pregnant patients should be limited to life threatening situations because of the significant human fetal risk. Bumetanide may result in dehydration and electrolyte depletion.

### **Drug Interactions**

Bumetanide may result in hypokalemia, which may cause patients who are also taking digitalis to develop digitalis toxicity.

### **Adverse Reactions**

Adverse reactions may include muscle cramps, dizziness, headache, nausea, vomiting, and orthostatic hypotension.

### **Dosage and Routes of Administration**

Bumex is similar to Lasix; however, it may be administered IM or IV (intravenous is preferable). The recommended adult dose of Bumex is 0.5 – 2 mg IV administered over one to two minutes; additional medication may be given as needed with medical direction.

## **CALCIUM CHLORIDE**

### **Description**

Calcium is an electrolyte essential for neuromuscular function, cardiac contractility, and blood coagulation.

### **Pharmacology**

Calcium increases the cardiac contractile state and is useful in reversing cardiac arrhythmias due to hyperkalemia (often associated with renal dialysis patients).

### **Indications**

Calcium is indicated for hyperkalemia, hypocalcemia, and calcium channel blocker overdose.

### **Onset/Duration**

Onset occurs within 5 – 15 minutes; duration is related to dose (may be up to 4 hours).

### **Contraindications**

Calcium is contraindicated in ventricular fibrillation, digitalis toxicity, and hypercalcemia.

### **Warnings**

Rapid injection may result in bradycardia. Calcium administration may produce coronary and cerebral artery spasm.

### **Drug Interactions**

Use with caution on patients taking digitalis as calcium may increase ventricular irritability and precipitate digitalis toxicity. If given with sodium bicarbonate, calcium salts will precipitate from solution. Calcium may antagonize vasodilatory action of verapamil.

### **Adverse Reactions**

Calcium may cause bradycardia, asystole, and hypotension.

### **Dosage and Routes of Administration**

For hypotension following administration of calcium channel blockers or prophylactic use prior to calcium channel blocker administration, the recommended adult dose is 2 to 4 mg/kg of 10% solution IV, slowly, which may be repeated as needed at 10 minute intervals. For hyperkalemia, hypocalcemia, hypermagnesemia, or calcium channel blocker overdose, the recommended dose is 8 – 16 mg/kg of 10% solution IV. An order from medical direction is required to administer calcium.

## **CALCIUM GLUCONATE**

### **Description**

Calcium gluconate is classified as a calcium salt.

### **Pharmacology**

Soluble calcium ions bind with soluble fluoride ions to produce the insoluble and therefore inactive calcium fluoride salt.

### **Indications**

Used in the treatment of hydrofluoric acid burns and hydrogen fluoride or other fluoride systemic toxicity.

### **Onset/Duration**

Rapid onset with a duration of 30 minutes to 2 hours.

### **Contraindications**

This medication is contraindicated with the following concurrent conditions: hypercalcemia, digoxin toxicity, and intoxication with other cardiac glycosides.

### **Warnings**

SQ or IM administration can cause severe tissue necrosis and tissue sloughing. Can induce serious cardiac dysrhythmias.

### **Drug Interactions**

None known in this setting.

### **Adverse Reactions**

Usually adverse reactions are seen in calcium overdosage. Clinical manifestation includes constipation, mouth drying, headache, anxiety, thirst, appetite loss, depression, metal taste, fatigue, and weakness. In fast parenteral injection nausea, vomiting, diarrhea, bradycardia, hypotension and, rarely, collapse may appear.

### **Dosage and Routes of Administration**

For skin burns, apply topical calcium gluconate gel after copious skin irrigation

Consider subcutaneous injection 0.5 ml per square cm burned – titrate to pain relief

Consider 10-30 mls IV administered to control cardiac dysrhythmias

**DEXAMETHASONE (DECADRON®)**

**Description**

Dexamethasone is a synthetic glucocorticoid.

**Pharmacology**

Dexamethasone is a potent anti-inflammatory and also modifies the immune response.

**Indications**

Dexamethasone is indicated for bronchial asthma and cerebral edema due to head injury or insult, as well as endocrine, rheumatic, dermatologic, ophthalmic, and hematologic disorders.

**Onset/Duration**

Onset is 4 - 8 hours; duration is 24 – 72 hours.

**Contraindications**

Dexamethasone is contraindicated in known hypersensitivity, neonates and patients with systemic fungal infections as it may exacerbate them.

**Warnings**

Risks to the fetus if used in pregnancy are unknown. Large doses of dexamethasone may result in blood pressure increases, salt and water retention, and increases in potassium and calcium excretion. Dexamethasone suppresses the immune system and may result in masking of infection or increased susceptibility to infection. Use of dexamethasone in patients with recent MI may result in myocardial rupture.

**Drug Interactions**

Dexamethasone may be less effective in the presence of phenytoin (Dilantin), phenobarbital, ephedrine, and rifampin. Hypokalemia may result if dexamethasone is administered in conjunction with potassium-depleting diuretics.

**Adverse Reactions**

Adverse reactions may include anaphylaxis, hypertension, weakness, seizures, headache, and nausea.

**Dosage and Routes of Administration**

By protocol, dexamethasone may be substituted for methylprednisolone, 12 mg of dexamethasone for 60 mg of methylprednisolone

Conversion Chart for Dexamethasone

Methylprednisolone		Dexamethasone
20 mg	Give	4 mg
40 mg	Give	8 mg
60 mg	Give	12 mg
125 mg	Give	20 mg

## **DEXTROSE**

### **Description**

Dextrose is the carbohydrate, *d-glucose*, a six-carbon sugar.

### **Pharmacology**

Dextrose administration results in a rapid increase in blood glucose.

### **Indications**

Dextrose is indicated for hypoglycemia and altered mental status, coma, or seizure of unknown etiology.

### **Onset/Duration**

The onset of dextrose is less than one minute with a duration dependent on the degree of hypoglycemia.

### **Contraindications**

Dextrose is contraindicated in intracranial hemorrhage, increased ICP, and known or suspected CVA in the absence of hypoglycemia.

### **Warnings**

Extravasation may result in tissue necrosis. Dextrose may worsen hyperglycemia and may induce acute thiamine deficiency (Wernicke-Korsakoff syndrome) in malnourished patients and chronic alcoholics.

### **Drug Interactions**

There are no known drug interactions.

### **Adverse Reactions**

Adverse reactions may include warmth, pain, burning, or phlebitis secondary to injection.

### **Dosage and Routes of Administration**

The adult recommended dose is up to 25 G IV if patients blood sugar is less than 80 mg/dl.

For pediatrics, if the patient's blood sugar is less than 80 mg/dl (40 mg/dl for newborn) via glucometer the dose is 2ml/kg of 25% dextrose. Neonates are to receive 5ml/kg of 10% dextrose IV or IO.

Dextrose may be mixed in a 100 ml bag of NSS and run wide open as an alternative to direct push of D50. This method is believed to be less caustic and easier on the diabetic patient.

## **DIAZEPAM (VALIUM®)**

### **Description**

Diazepam is a benzodiazepine derivative.

### **Pharmacology**

Diazepam appears to act on the thalamus and hypothalamus by inducing calming effects and raising the seizure threshold by potentiating the effects of inhibitory neurotransmitters.

### **Indications**

Diazepam is indicated for the management of status epilepticus, anxiety, acute alcohol withdrawal, and skeletal muscle spasm. Diazepam is also indicated for the management of the seizing patient post nerve agent exposure.

### **Onset/Duration**

The onset of IV diazepam is 1-5 with an IM onset of 15-30 minutes. The duration is 15 minutes to one hour.

### **Contraindications**

Diazepam is contraindicated in known hypersensitivity, drug abuse, coma, shock, or head injury induced CNS depression. There are no contraindications to a post nerve agent exposure patient that is seizing.

### **Warnings**

See drug interactions below.

### **Drug Interactions**

Diazepam may result in significant CNS depression when administered with other CNS depressants. Diazepam should not be administered with other IV medications as it may form a precipitate.

### **Adverse Reactions**

Adverse reactions may include hypotension, tachycardia, respiratory depression, confusion, nausea, and impairment.

### **Dosage and Routes of Administration**

Diazepam autoinjector dose is 10mg IM.

## **DILTIAZEM HYDROCHLORIDE (CARDIZEM®)**

### **Description**

Diltiazem is a calcium channel blocker.

### **Pharmacology**

Diltiazem inhibits the influx of calcium ions during membrane depolarization of cardiac and vascular smooth muscle. Diltiazem slows AV node conduction and prolongs refractoriness of the AV node. Because of its effect on vascular smooth muscle, diltiazem decreases peripheral vascular resistance and blood pressure.

### **Indications**

Diltiazem is indicated for temporary control of atrial fibrillation or atrial flutter with rapid ventricular response or PSVT.

### **Onset/Duration**

Onset is within 2 to 5 minutes; duration is approximately 3 hours.

### **Contraindications**

Diltiazem is contraindicated in patients with sick sinus syndrome or second- or third-degree AV block unless a pacemaker is present. Diltiazem is contraindicated in patients with WPW or short PR syndromes, ventricular tachycardia, profound hypotension, or cardiogenic shock, as well as those with a known hypersensitivity.

### **Warnings**

Prolongation of AV node conduction may result in second- or third-degree AV block. Diltiazem should not be administered to patients with a compromised myocardium, i.e. those with severe CHF, AMI, or cardiomyopathy. Use caution when giving diltiazem to hypotensive patients. Diltiazem may result in hepatic injury.

### **Drug Interactions**

Intravenous diltiazem and beta blockers should not be administered together or within a few hours. Diltiazem may potentiate the effects of anesthetics on cardiac contractility, conductivity, and automaticity. Diltiazem may elevate levels of carbamazepine (Tegretol®), which could result in toxicity.

### **Adverse Reactions**

Adverse reactions to diltiazem may include hypotension, asystole, AV block, bradycardia, chest pain, CHF, ventricular arrhythmias, flushing, injection site reactions, nausea, vomiting, and dizziness.

### **Dosage and Routes of Administration**

The initial adult dose of diltiazem is 0.25 mg/kg via IV over 2 minutes, as described in the adult stable tachycardia protocol. If there is no response to the initial dose after 15 minutes, contact medical control for a second dose of 0.35 mg/kg via IV over 2 minutes. Contact medical control if the patient is taking Digoxin.

## **DIPHENHYDRAMINE HYDROCHLORIDE (BENADRYL®)**

### **Description**

Diphenhydramine is an antihistamine.

### **Pharmacology**

Diphenhydramine prevents the symptomatic physiologic effects of histamine by blocking H<sub>1</sub> and H<sub>2</sub> receptor sites.

### **Indications**

Diphenhydramine is indicated for moderate to severe allergic reactions, motion sickness, insomnia, and drug-induced extrapyramidal symptoms.

### **Onset/Duration**

Onset of action occurs within 15 minutes if given intravenously with a peak effect at 1 - 4 hours. Duration is 6 – 12 hours.

### **Contraindications**

Diphenhydramine is contraindicated in known hypersensitivity, CNS depression, and narrow angle glaucoma.

### **Warnings**

Diphenhydramine should be used with caution in patients with severe vomiting, asthma, and alcohol intoxication.

### **Drug Interactions**

MAO inhibitors may prolong and potentiate diphenhydramine.

### **Adverse Reactions**

Adverse reactions may include drowsiness, thickening of bronchial secretions, hypotension, tachycardia, bradycardia, and dry mouth.

### **Dosage and Routes of Administration**

By protocol, the dose is 25 – 50 mg IV, IM, or PO for moderate allergic reactions or 50 mg IV for severe reactions.

By protocol, the pediatric dose is 12.5 – 25 mg PO for moderate allergic reactions or 1 mg/kg (up to 50 mg) IV or IM for severe reactions.

## **DOPAMINE HYDROCHLORIDE (INTROPIN®)**

### **Description**

Dopamine is a sympathomimetic.

### **Pharmacology**

Dopamine acts on  $\alpha_1$  and  $\beta_1$  adrenergic receptors dose-dependently. At low doses, dopamine has a dopaminergic effect that results in renal, mesenteric, and cerebral vasodilation. At moderate doses, dopamine's  $\alpha$  and  $\beta_1$  effects result in increased cardiac contractility, cardiac output, and blood pressure. At high doses, dopamine has pure  $\alpha$  effects, exhibited by peripheral vasoconstriction.

### **Indications**

Dopamine is indicated for significant hypotension not secondary to hypovolemia, such as cardiogenic shock and septic shock; to promote urine output at low doses; and in conjunction with other agents for the treatment of chronic refractory congestive heart failure.

### **Onset/Duration**

The onset of dopamine is extremely rapid but the duration is very brief; onset is within 2 to 4 minutes with a duration of 10 – 15 minutes.

### **Contraindications**

Dopamine is contraindicated in tachydysrhythmias, ventricular fibrillation, hypovolemic shock or pheochromocytoma.

### **Warnings**

At high doses, dopamine may cause profound vasoconstriction which may compromise blood flow to vital organs or extremities. Dopamine may result in increased myocardial oxygen demand and may also promote supraventricular and ventricular arrhythmias. Do not add dopamine to an alkaline solution since the drug is inactivated in alkaline solution. Patients with pheochromocytoma are extremely sensitive to dopamine and may develop profound hypertension in response to minimal doses.

The recommended adult doses via IV drip are as follows:

- For a dopaminergic response: 1 – 2 mcg/kg/min
- For a  $\beta$  adrenergic response: 2 – 10 mcg/kg/min
- For an  $\alpha$  adrenergic response: 10 – 20 mcg/kg/min

### **Drug Interactions**

Patients receiving monoamine oxidase (MAO) inhibitors are extremely sensitive to the effects of dopamine and should receive a much lower dose than is usually given.

### **Adverse Reactions**

Adverse reactions may include nausea, vomiting, tachycardia, anginal pain and hypertension.

### **Dosage and Routes of Administration**

By protocol, dopamine requires an order from medical direction; 5 – 20 mcg/kg/min dopamine infusion for continued hypotension not due to hypovolemia.

For induced hypothermia, maintain a MAP of 90-100 mmHg using a 10-20 mcg/kg/min dopamine infusion under standing order.

Dopamine is not listed in the pediatric protocols and would require an order for medical direction, recommended pediatric dose is 10-20 mcg/kg/min.

*The infusion rate for both adults and pediatrics should be adjusted to blood pressure and clinical response in the prehospital setting.*

## **DUODOTE™**

### **Description**

The DuoDote Auto-Injector provides a single intramuscular dose of atropine and pralidoxime chloride. It is to be used as a self-administered therapy for symptomatic exposure to anticholinergic nerve agents and organophosphorus pesticides.

Each DuoDote Auto-Injector contains 2.1 mg. of Atropine Sulfate and 600 mg of Pralidoxime Chloride.

### **Pharmacology**

Atropine competitively blocks the effects of acetylcholine at muscarinic cholinergic receptors on smooth muscle, cardiac muscle, secretory gland cells and in peripheral autonomic ganglia and the central nervous system.

Pralidoxime reactivates acetylcholinesterase which has been inactivated by phosphorylation due to some organophosphorous nerve agents or pesticides. Pralidoxime does not reactivate phosphorylated acetylcholinesterase that has undergone the aging process.

### **Indications**

DuoDote is indicated for the treatment of poisoning by organophosphorous nerve agents and pesticides.

### **Onset/Duration**

Onset of action for both drugs is rapid (peak effect achieved in  $\leq 5$  minutes). Both drugs last for approximately an hour.

### **Contraindications**

None in the presence of life-threatening organophosphorous poisoning.

### **Warnings**

Pralidoxime is secreted in the urine – impaired renal function may result in higher blood levels.

### **Drug Interactions**

When administered together, pralidoxime may potentiate the effects of atropine. This could result in signs of atropinization (flushing, mydriasis, tachycardia, dryness of mouth and nose) occurring earlier than when atropine is given alone.

Succinylcholine is metabolized by cholinesterases. Since pralidoxime reactivates cholinesterase, use of pralidoxime may accelerate reversal of neuromuscular blocking effects of succinylcholine.

### **Adverse Reactions**

Temporary hypertension caused by pralidoxime.

Signs of atropinization may occur earlier when both drugs given together

### **Dosage and Routes of Administration**

Moderate symptoms: Administer 1 DuoDote IM  
Severe symptoms: Administer 3 DuoDotes IM

## **EPINEPHRINE**

### **Description**

Epinephrine is a sympathomimetic.

### **Pharmacology**

Epinephrine stimulates alpha and beta adrenergic receptors, causing increases in the systemic vascular resistance, systemic arterial pressure, heart rate, contractile state, myocardial oxygen requirement, and cardiac automaticity.

### **Indications**

Epinephrine is the primary drug for the treatment of cardiac arrest and anaphylactic shock.

### **Onset/Duration**

The onset is 1-2 minutes via IV and 5-10 minutes IM. The duration is 5-10 minutes.

### **Contraindications**

Epinephrine is contraindicated in known hypersensitivity, hypovolemic shock, and hypertension.

### **Warnings**

Epinephrine causes a dramatic increase in myocardial oxygen demand and its use in the setting of an acute MI should be restricted to cardiac arrest.

### **Drug Interactions**

Do not mix with sodium bicarbonate as this inactivates epinephrine. MAO inhibitors and bretylium may potentiate epinephrine. Beta antagonists may negatively affect epinephrine. Sympathomimetics and phosphodiesterase inhibitors may act as proarrhythmics in conjunction with epinephrine.

### **Adverse Reactions**

Adverse reactions may include headache, nausea, restlessness, weakness, dysrhythmias, hypertension, and angina.

### **Dosage and Routes of Administration**

For cardiac arrest, the adult dose is 1 mg (1:10,000) IV every 3-5 minutes, which correlates with the adult v-fib/pulseless VT and asystole/PEA protocols. For pediatric arrest and pediatric bradycardia, the dose is 0.01 mg/kg of 1:10,000 via IV, repeat every 3-5 minutes.

For allergic reactions, the adult dose is 0.25 mg IV of 1:10,000 over a 1 minute interval or 0.5 mg IM of 1:1,000. For pediatric anaphylaxis the IV dose is 0.01 mg/kg of 1:10,000 which may be repeated x1 if no improvement is noted. The dose is 0.01 mg/kg IM of 1:1000, (maximum of 0.3 mg) if unable to establish IV access.

## **ETOMIDATE (AMIDATE®)**

### **Description**

Etomidate is a general anesthetic and hypnotic without analgesic properties.

### **Pharmacology**

Etomidate appears to act similar to GABA by depressing the activity of the brain stem reticular activating system.

### **Indications**

Etomidate is indicated for induction of general anesthesia and sedation of critically ill patients and prior to cardioversion or intubation.

### **Onset/Duration**

Onset occurs within one minute and lasts 3-10 minutes.

### **Contraindications**

Etomidate is contraindicated in known hypersensitivity.

### **Warnings**

Etomidate is not intended for prolonged infusion due to suppression of cortisol and aldosterone production. **Causes respiratory paralysis; supportive airway control must be continuous and under direct observation at all times.**

### **Drug Interactions**

The most common interaction of etomidate with many prescription medications, such as alpha blockers, beta blockers, and antipsychotics, to name a few, is the increased risk of hypotension. Administration of etomidate to patients taking Verapamil may also result in increased hypotension as well as AV delay.

### **Adverse Reactions**

Adverse reactions may include myoclonic skeletal muscle movements, post-operative nausea and vomiting, pain at the injection site, apnea, hypoventilation or hyperventilation, laryngospasm, hypertension or hypotension, and tachycardia or bradycardia.

### **Dosage and Routes of Administration**

- For sedation of adult and pediatric patients prior to cardioversion, the standard dose is 0.2mg/kg (max 20 mg for peds).
- Standard dose under the DFI protocol is 20 mg for adults and 0.4mg/kg (to a max of 20 mg) for pediatric patients.

## **FENTANYL CITRATE (SUBLIMAZE®)**

### **Description**

Fentanyl citrate is a potent synthetic opioid agonist.

### **Pharmacology**

Fentanyl citrate acts primarily through interaction with opioid mu-receptors located in the brain, spinal cord and smooth muscle. The primary site of therapeutic action is the central nervous system causing analgesia and euphoria, effectively treating moderate to severe pain.

### **Indications**

Fentanyl citrate is indicated for acute myocardial infarction, acute pulmonary edema, and pain management.

### **Onset/Duration**

The onset is extremely rapid (within seconds) following intravenous administration with a duration of 30-60 minutes.

### **Contraindications**

Fentanyl citrate is contraindicated in known hypersensitivity, hypovolemia, hypotension and head injury.

### **Warnings**

Fentanyl citrate may result in respiratory depression. It has been rarely linked to muscle rigidity, particularly involving the muscles of respiration. This rigidity has been reported to occur or recur infrequently in the extended postoperative period usually following high dose administration.

### **Drug Interactions**

Fentanyl citrate may be potentiated by CNS depressants. Paradoxical excitation may result if given in conjunction with MAO inhibitors.

### **Adverse Reactions**

Adverse reactions may include bradycardia, restlessness, circulatory depression, respiratory depression, and euphoria.

### **Dosage and Routes of Administration**

For moderate to severe pain and for STEMI and ACS, consider administration of up to 50 mcg Fentanyl IV, IN with an additional 50 mcg Fentanyl IV or IN administered after 5 minutes for continued moderate to severe pain.

For moderate to severe pain in a pediatric patient, consider administration of 2 mcg/kg Fentanyl IV or IN to a max dose of 50 mcg with an additional 2 mcg/kg Fentanyl IV or IN (after 5 minutes) to a max dose of 50 mcg for continued moderate to severe pain.

## **FUROSEMIDE (LASIX®)**

### **Description**

Furosemide is a potent loop diuretic.

### **Pharmacology**

Furosemide inhibits reabsorption of sodium in the proximal tubule and descending loop of Henle.

### **Indications**

Furosemide is indicated for acute pulmonary edema and congestive heart failure.

### **Onset/Duration**

The onset of action typically occurs within 15-20 minutes; the duration is 4 to 6 hours.

### **Contraindications**

Furosemide is contraindicated in known hypersensitivity, anuria, hypovolemia, dehydration, and electrolyte depletion.

### **Warnings**

The administration of furosemide may aggravate dehydration, hypovolemia, hypotension, hyperosmolality, and hypokalemia.

### **Drug Interactions**

Furosemide may result in sodium and potassium depletion and may potentiate digitalis and lithium toxicity.

### **Adverse Reactions**

Adverse reactions may include hypotension, ECG changes, chest pain, hypokalemia, hyponatremia, and hyperglycemia.

### **Dosage and Routes of Administration**

The dosage of intravenous furosemide ranges from 10 mg to 120 mg with an average dose of approximately 40 mg intravenously; the dose calculation is based on the patient's daily dose. By standing order, the patient may be given their total daily dose intravenously or if the dose is unknown, 40 mg. Medical direction must be consulted for doses greater than 120 mg or for patients not prescribed furosemide.

## **GLUCAGON**

### **Description**

Glucagon is a naturally occurring hormone in the body and is synthesized by the pancreas; it is an antagonist to insulin.

### **Pharmacology**

Glucagon increases blood sugar by breaking down glycogen stored in the liver; it also inhibits gastrointestinal motility by smooth muscle relaxation. Glucagon may also increase heart rate and cardiac output, decrease blood pressure, and increase metabolic rate.

### **Indications**

Glucagon is used to treat hypoglycemia, beta-blocker overdoses, and for relaxation of GI smooth muscle.

### **Onset/Duration**

Onset may occur within one minute; however, maximum activity occurs within 30 minutes; duration is limited to 1 to 2 hours.

### **Contraindications**

Glucagon is contraindicated in known hypersensitivity.

### **Warnings**

Glucagon only works to correct hypoglycemia if the liver has significant glycogen stores.

### **Drug Interactions**

There are no known drug interactions with glucagon.

### **Adverse Reactions**

Glucagon may cause nausea and vomiting.

### **Dosage and Routes of Administration**

For adults, the dose by protocol to treat hypoglycemia 1 mg IM or IN if unable to obtain IV access. For pediatrics the dose is 1 mg IM or IN by protocol (if unable to obtain IV access).

*For beta blocker overdose the dose is 1-5 mg slow IV push for adults and 0.015 – 0.1 mg/kg for pediatrics; however, this requires an order from medical direction. Glucagon is incompatible with Normal Saline- only compatible with D5W.*

## **HALOPERIDOL (HALDOL®)**

### **Description**

Haloperidol is a potent tranquilizer.

### **Pharmacology**

The mechanism of action of haloperidol is unknown. Haloperidol is believed to act as a dopamine antagonist, correcting an imbalance of that neurotransmitter in the brain. Haloperidol is used frequently to manage acute psychosis and to control non-psychotic agitation.

### **Indications**

Haloperidol is indicated for acute psychosis and combativeness.

### **Onset/Duration**

The onset of action with an IM injection is within 5 minutes; however, peak effectiveness may not be reached until 15-45 minutes. Duration is typically 4 to 8 hours.

### **Contraindications**

Haloperidol is contraindicated in the presence of other sedatives (with the exception of benzodiazepines), cardiac disease, and Parkinson's disease. Haloperidol is also contraindicated for patients with a known allergy to neuroleptic antipsychotic medications such as Thorazine®, Droperidol®, Prolixin®, and Mellaril®.

### **Warnings**

Administering haloperidol to a patient who has a history of seizures or who is taking anti-convulsant medications may precipitate convulsion activity; haloperidol reduces the convulsion threshold and anticonvulsant medications decrease the effects of haloperidol. Geriatric patients should receive a decreased dose to reduce the possibility of side effects due to decreased liver function.

### **Drug Interactions**

Haldol is also contraindicated in patients who are taking Talwin®. Talwin® is a potent analgesic combination; its use with haloperidol will result in additive depression. Antihypertensive medications may have an additive effect with haloperidol, increasing the possibility of orthostatic hypotension.

### **Adverse Reactions**

Adverse reactions may include physical and mental impairment, dystonic reactions, akathisia, dry mouth, blurred vision, and orthostatic hypotension.

### **Dosage and Routes of Administration**

Adult General Patient Care Protocol requires an order from medical direction to administer haloperidol up to 5 mg IV or IM for sedation. The dosage should be decreased for elderly and debilitated patients to a range of 1 – 2 mg IM.

## **HYDROXOCOBALAMIN (CYANOKIT<sup>®</sup>)**

### **Description**

Hydroxocobalamin is an antidote for treatment of known or suspected cyanide poisoning.

### **Pharmacology**

Hydroxocobalamin binds to the cyanide ion to form cyanocobalamin (Vitamin B12) which is then excreted in the urine.

### **Indications**

Hydroxocobalamin is indicated for the treatment of known or suspected cyanide poisoning.

### **Onset/Duration**

The majority of the urinary excretion occurred during the first 24-hours after administration, but red-colored urine was observed for up to 35 days following IV infusion.

### **Contraindications**

None

### **Warnings**

Transient episodes of hypertension have been noted. Use caution in patients with known anaphylactic reaction to hydroxocobalamin or cyanocobalamin.

### **Drug Interactions**

Administration of the following drugs through the same IV line as hydroxocobalamin may result in particle formation: diazepam, dopamine, and fentanyl. Chemical incompatibility was observed with sodium thiosulfate, sodium nitrite and ascorbic acid.

### **Adverse Reactions**

Red colored urine, redness at the infusion site and erythema were frequently reported. Other adverse reactions include: hypertension, rash, nausea, headache, dizziness.

### **Dosage and Routes of Administration**

5 grams (2 vials) IV infusion over 15 minutes. In cases of severe exposure or when the patient's clinical response to the first dose is inadequate, a second 5 gram dose may be administered – infuse over 15 minutes (for patient in extremis) to 2 hours.

Cyanokit is available as 2.5 grams of lyophilized hydroxocobalamin in a 250 ml glass vial. Reconstitute with 100 ml of normal saline and mix by repeatedly inverting vial for 30 seconds – do not shake. Inspect after mixing – if the solution is not dark red or there are visible particulate matter, do not use.

Safety and efficacy has not been established in pediatric populations. A 70 mg/kg dose has been used in non-US marketing experience.

## **IPRATROPIUM BROMIDE (ATROVENT®)**

### **Description**

Ipratropium bromide is an anticholinergic (parasympatholytic) agent, which causes localized bronchodilation.

### **Pharmacology**

Chemically related to atropine, ipratropium bromide inhibits vagally-mediated reflexes and increases in cyclic GMP by antagonizing acetylcholine, thus relaxing bronchial smooth muscle and drying respiratory tract secretions.

### **Indications**

Ipratropium bromide is indicated for asthma and bronchospasm associated with COPD.

### **Onset/Duration**

Onset of action for ipratropium bromide may occur within 15-30 minutes with a peak effect in 1-2 hours. The duration is 4-8 hours.

### **Contraindications**

Ipratropium bromide should not be used in people with a known hypersensitivity to the medication (or to atropine) and it should not be used as the primary acute treatment of bronchospasm.

### **Warnings**

Ipratropium bromide should be used with caution in patients with hepatic and renal insufficiency due to lack of research. It should also be used with caution in patients with narrow-angle glaucoma, prostatic hypertrophy, and bladder obstruction.

### **Drug Interactions**

There are no known drug interactions with ipratropium bromide.

### **Adverse Reactions**

Side effects may include palpitations, dizziness, anxiety, headache, eye pain, urinary retention, and nervousness.

### **Dosage and Routes of Administration**

By protocol, the dosage of ipratropium bromide is 500 mcg via nebulizer (administered with albuterol or patients own Xopenex) for adults and children over 2 years of age; in children less than 2 years of age there must be an order from medical control.

## **LEVALBUTEROL HYDROCHLORIDE (Xopenex®)**

### **Description**

This drug is classified as a sympathomimetic bronchodilator.

### **Pharmacology**

Beta-adrenergic agonist causing bronchodilation and relaxation of smooth muscles of all airways.

### **Indications**

Treatment for bronchospasm

### **Onset/Duration**

Duration of up to 8 hours.

### **Contraindications**

Hypersensitivity to Xopenex or racemic albuterol.

### **Warnings**

Should be discontinued if QT prolongation, ST segment depression, paradoxical bronchospasm or hypersensitivity reaction occurs, such as urticaria, angioedema, rash or oral edema.

### **Drug Interactions**

Can have undesirable effects with beta-blockers, diuretics and digoxin. Patients taking Monoamine Oxidase Inhibitors (MAOI's) and Tricyclic antidepressants (TCA's) should have been discontinued for 2 weeks prior to administration of Levalbuterol.

### **Adverse Reactions**

Adverse reactions may include: tachycardia, arrhythmias, anginal pain, restlessness, anxiety, dizziness, headache, and hypokalemia.

### **Dosage and Routes of Administration**

Adult:                   (≥ 12 years of age)  
                              0.63 mg via nebulizer

Pediatric:               (6-11 years of age)  
                              0.31 mg via nebulizer

*Patients over 12y/o may receive 1.25 mg via nebulaizer for severe asthma or that have not responded to 0.63 mg.*

### *How Packaged*

*0.31 mg/3ml's*

*0.63 mg/3ml's*

*1.25 mg/3ml's*

*Packaged in light protective foil and once removed must be protected from light.*

## **LIDOCAINE (XYLOCAINE®)**

### **Description**

Lidocaine is an anesthetic and antiarrhythmic.

### **Pharmacology**

Lidocaine suppresses ventricular ectopy and elevates the ventricular tachycardia (VT) and ventricular fibrillation (VF) threshold by decreasing diastolic depolarization.

### **Indications**

Lidocaine is used to suppress or prevent ventricular premature complexes especially in the setting of myocardial ischemia or infarction and for the treatment of VT and VF.

### **Onset/Duration**

The onset of lidocaine is extremely rapid (within minutes) following intravenous administration. The duration is 2-4 hours.

### **Contraindications**

Lidocaine is contraindicated in hypersensitivity, Stokes-Adams syndrome, and in second- or third-degree heart block in the absence of a pacemaker.

### **Warnings**

Lidocaine may cause clinical evidence of toxicity usually related to the central nervous system, such as muscle twitching, slurred speech, altered mental status, decreased hearing, paresthesia, and seizures. Reduce the dosage by half in elderly patients and those with decreased cardiac output or liver dysfunction.

### **Drug Interactions**

Beta blockers may decrease metabolism of lidocaine. Cardiac depression may occur if given in conjunction with phenytoin (Dilantin®). Administration with procainamide may result in additive neurologic effects.

### **Adverse Reactions**

Adverse reactions may include lightheadedness, altered mental status, hypotension, and bradycardia.

### **Dosage and Routes of Administration**

- Lidocaine 1.5mg/kg IV is administered for suspected intracranial insult with DFI Protocol.
- For conscious patients in whom IO access has been achieved, administer Lidocaine 20-40 mg (0.5-1 mg/kg for pediatric patients) over 1 minute prior to flushing with saline.

## **MAGNESIUM SULFATE**

### **Description**

Magnesium sulfate is an electrolyte, a smooth muscle relaxant and a CNS depressant.

### **Pharmacology**

Magnesium sulfate reduces acetylcholine release at the neuromuscular junction, reducing muscle contractions and promoting muscle relaxation.

### **Indications**

Magnesium sulfate is indicated for seizures associated with eclampsia, as a bronchodilator, for replacement of magnesium in hypomagnesemia, and for the treatment of Torsades de Pointes as well as refractory VT/VF.

### **Onset/Duration**

The onset of action is 3 to 5 minutes following intravenous administration with a duration of 30 minutes.

### **Contraindications**

Magnesium is contraindicated in known hypersensitivity, heart block, and renal failure.

### **Warnings**

Respiratory depression may occur with rapid intravenous administration.

### **Drug Interactions**

Magnesium sulfate may have additive CNS effects when administered with other CNS depressants.

### **Adverse Reactions**

Adverse reactions may include flushing, loss of tendon reflexes, impairment of mental and psychomotor function, confusion, and apnea with high doses.

### **Dosage and Routes of Administration**

The recommended adult dose is 1-2 G for Torsades, VT, or VF. By protocol, the adult dose is 1-2 G IV over 10 minutes for severe asthma or COPD, which requires an order from medical direction. For seizures due to eclampsia, the dose is 5 G over 10 minutes intravenously. For VF/VT, the dose is 2 G IV.

The use of Magnesium sulfate in a pediatric population is by physician order, the dose is 25 mg/kg infused over 10 minutes for severe respiratory distress.

Magnesium sulfate should be mixed in 100 ml of NSS and infused over 10 minutes for non VF/VT patients.

## **METHYLPREDNISOLONE SODIUM SUCCINATE (SOLU-MEDROL®)**

### **Description**

Methylprednisolone is a potent anti-inflammatory synthetic steroid.

### **Pharmacology**

Methylprednisolone suppresses acute and chronic inflammation, potentiates vascular smooth muscle relaxation, and may alter airway hyperactivity.

### **Indications**

Methylprednisolone is indicated for control of severe allergic reactions, asthmatic attacks and bronchospasm associated with COPD that do not respond to other treatments.

### **Onset/Duration**

The onset of action is 1 to 2 hours following intravenous administration, with a peak effect and duration ranging from 8 to 24 hours.

### **Contraindications**

Methylprednisolone is contraindicated in known hypersensitivity.

### **Warnings**

Methylprednisolone should be used with caution in pregnant patients and patients with GI bleeding. It should also be used with caution in patients with diabetes mellitus, as hypoglycemic responses to insulin and oral hypoglycemic agents may be blunted. Hold steroids for suspected pneumonia, CHF or "metabolic hyperventilation" (DKA, sepsis, etc.).

### **Drug Interactions**

Potassium-depleting agents may potentiate hypokalemia induced by corticosteroids.

### **Adverse Reactions**

Adverse reactions may include headache, hypertension, sodium and water retention, hypokalemia, alkalosis, gastritis, and steroid-induced psychosis.

### **Dosage and Routes of Administration**

The adult dose is 125 mg IV over 3-5 minutes for severe respiratory distress and anaphylaxis.

The pediatric dose is 2 mg/kg IV (max of 125 mg) for respiratory distress and anaphylaxis.

## **MIDAZOLAM (VERSED®)**

### **Description**

Midazolam is a benzodiazepine.

### **Pharmacology**

Midazolam is useful for sedation, hypnosis, alleviation of anxiety, muscle relaxation, and anticonvulsant activity, while having little cardiovascular effect.

### **Indications**

Conscious sedation as an adjunct to cardioversion and intubation. Adjunct for chemical restraint. Consideration for administration should be given for ACS/STEMI patients believed to be also under the influence of cocaine.

### **Onset/Duration**

The onset of action is 3 to 5 minutes following intravenous administration and 15 minutes following intramuscular injection, with a peak effect ranging from 30 to 60 minutes, and a duration of 2-6 hours.

### **Contraindications**

Midazolam is contraindicated in known hypersensitivity, glaucoma, and coma.

### **Warnings**

Midazolam should be used with caution with patients with altered mental status. Respiratory depression may occur.

### **Drug Interactions**

Midazolam may be potentiated by CNS depressants, such as alcohol, narcotics, and barbiturates.

### **Adverse Reactions**

Adverse reactions may include lightheadedness, motor impairment, ataxia, impairment of mental and psychomotor function, confusion, slurred speech, and amnesia.

### **Dosage and Routes of Administration**

- The adult dose by protocol, up to 5 mg IV, IM or IN may be given for seizures and post-intubation sedation.
- Pediatric protocol states the dose is 0.2 mg/kg to a max of 5 mg IV, IM or IN for seizures, or 0.1 mg/kg for post-intubation sedation.
- If the patient is experiencing discomfort due to pacing and the systolic blood pressure is greater than or equal to 100 mmHg, administer up to 5 mg IV or IN for sedation.

## **MORPHINE SULFATE**

### **Description**

Morphine sulfate is an opioid analgesic.

### **Pharmacology**

Morphine sulfate is a natural opioid and increases vasodilation while decreasing venous return and systemic vascular resistance, thus decreasing myocardial oxygen demand. It also produces analgesia and euphoria, thus effectively treating moderate to severe pain.

### **Indications**

Morphine sulfate is indicated for acute myocardial infarction, acute pulmonary edema, and pain management.

### **Onset/Duration**

The onset is extremely rapid (within minutes) following intravenous administration with a duration of 2-7 hours.

### **Contraindications**

Morphine sulfate is contraindicated in known hypersensitivity, hypovolemia, hypotension, and head injury.

### **Warnings**

Morphine sulfate may result in respiratory depression and hypotension (especially in patients who are volume depleted or those with increased systemic vascular resistance).

### **Drug Interactions**

Morphine sulfate may be potentiated by CNS depressants and chlorpromazine (Thorazine®). Paradoxical excitation may result if given in conjunction with MAO inhibitors.

### **Adverse Reactions**

Adverse reactions may include hypotension, tachycardia, bradycardia, palpitations, syncope, flushing, respiratory depression, and euphoria.

### **Dosage and Routes of Administration**

*If fentanyl is unavailable*, the pain management protocol enables the paramedic to give up to 5 mg of morphine sulfate for moderate to severe pain in the adult patient, which may be repeated once prior to contacting medical control. By protocol, the adult dose is up to 5 mg on standing order for acute coronary syndromes and STEMI, which may be repeated once prior to contacting medical control.

The recommended pediatric dose is 0.05 to 0.1 mg/kg (up to 5 mg) which may be repeated prior to contacting medical control.

## **NALOXONE (NARCAN®)**

### **Description**

Naloxone is an opioid antagonist.

### **Pharmacology**

Naloxone is a competitive narcotic antagonist, which reverses all effects of opioids (i.e. morphine), such as respiratory depression and central and peripheral nervous system effects.

### **Indications**

Naloxone is indicated to reverse respiratory and central nervous system depression induced by opioids.

### **Onset/Duration**

The onset of action is within a few minutes following an intravenous dose, whereas intramuscular and endotracheal/intranasal administration results in a slower onset of action. The duration of action is approximately 30-60 minutes.

### **Contraindications**

Naloxone is contraindicated in hypersensitivity.

### **Warnings**

Naloxone may induce opiate withdrawal in patients who are physically dependent. Certain drugs such as propoxyphene (darvon) may require much higher doses of naloxone for reversal than we currently carry.

### **Drug Interactions**

Naloxone is incompatible with bisulfite and alkaline solutions.

### **Adverse Reactions**

Adverse reactions may include tachycardia, hypertension, dysrhythmias, nausea, vomiting, and diaphoresis.

### **Dosage and Routes of Administration**

Consider the administration of 0.4 - 2 mg naloxone (Narcan®) IV, IN, or IM to provide for a patent, self-maintained airway and adequate respirations.

For pediatric patients, consider the administration of up to 0.1 mg/kg naloxone (Narcan®) IV, IN, or IM (maximum dose is 2 mg) for suspected drug overdose.

## **NITROGLYCERIN**

### **Description**

Nitroglycerin is a vasodilator.

### **Pharmacology**

Nitrates have a peripheral vasodilatory effect, thus reducing preload and decreasing myocardial oxygen demand.

### **Indications**

Nitroglycerin is indicated for the treatment of acute coronary syndromes and acute pulmonary edema.

### **Onset/Duration**

When absorbed through the skin, nitroglycerin has an onset of 30-60 minutes and a duration of 3 to 6 hours. Absorbed through the oral mucosa, the onset is 1-3 minutes with a duration of 20-30 minutes.

### **Contraindications**

Nitroglycerin is contraindicated in known hypersensitivity, hypotension, and cerebral hemorrhage or head injury. Withhold if the patient has taken Viagra/Levitra within 24 hours and Cialis/Revatio within 48 hours.

### **Warnings**

Nitroglycerin may cause hypotension, especially if given in conjunction with other vasodilators.

### **Drug Interactions**

See above.

### **Adverse Reactions**

Adverse reactions are dose-related but may include headache, hypotension, nausea, vomiting, and dizziness.

### **Dosage and Routes of Administration**

- By protocol, the adult dose is 0.4 mg SL every 3-5 minutes for the duration of chest pain, anxiety, or signs of ischemia or injury, and is given in conjunction with one inch of NTG paste. For pulmonary edema due to congestive heart failure, nitroglycerin may be administered as an initial 0.4 mg SL dose followed in 3-5 minutes by subsequent doses of 0.8 mg SL. These subsequent doses should be repeated every 3-5 minutes as long as BP remains above 120 mm Hg systolic.
- Nitroglycerin is not recommended for pediatric use.

## **ONDANSTERON (ZOFTRAN®)**

### **Description**

Ondansteron is an anti-emetic.

### **Pharmacology**

Ondansetron helps to prevent nausea and vomiting by blocking 5-HT<sub>3</sub> receptors so that serotonin is not able to bind to the receptor site and initiate a vomiting reflex.

### **Indications**

Ondansteron is indicated for patients experiencing nausea and vomiting.

### **Onset/Duration**

The onset of action occurs within minutes for IV administration and within 30 minutes for ODT administration. Peak time is around two hours with a duration of 3-6 hours.

### **Contraindications**

The only contraindication is a known hypersensitivity to Ondansteron.

### **Warnings**

Hypersensitivity reactions have been reported in patients who have exhibited hypersensitivity to other selective 5-HT<sub>3</sub> receptor antagonists.

### **Drug Interactions**

There are no drug interactions with Ondansteron.

### **Adverse Reactions**

Adverse reactions are diarrhea, headache, fever, Rarely seen are angina chest pain, seizures, akathisia and acute dystonic reactions.

### **Dosage and Routes of Administration**

The recommended adult dose is 4 mg ODT, IV or IM.

The recommended pediatric dose is 2 mg (older than 2 years and under the age of 6 years) or 4 mg (6 years or older) ODT, IV or IM.

## **OXYGEN**

### **Description**

Oxygen is a naturally occurring gas.

### **Pharmacology**

Oxygen is present in room air at a concentration of approximately 21%. Providing supplemental oxygen elevates oxygen tension and increases oxygen content in the blood, thus improving tissue oxygenation, promoting aerobic metabolism, and reversing hypoxemia.

### **Indications**

Oxygen is indicated for acute coronary syndromes, suspected hypoxemia of any etiology, cardiopulmonary arrest, and trauma.

### **Onset/Duration**

The onset of action occurs within minutes and the duration is depended upon constant provision.

### **Contraindications**

There are no known contraindications in providing oxygen.

### **Warnings**

The main precaution is not administering enough oxygen to patients who need it. Never withhold oxygen from those in obvious need, but keep in mind that oxygen should be given with caution to patients with COPD and chronic carbon dioxide retention.

### **Drug Interactions**

There are no drug interactions with oxygen.

### **Adverse Reactions**

Decreased levels of consciousness and respiratory depression may result from administering high levels of oxygen to patients with COPD and chronic carbon dioxide retention.

### **Dosage and Routes of Administration**

The recommended adult and pediatric dosages are 1-15 L/min via nasal cannula, nebulizer, nonrebreather mask, or bag-valve mask.

## **PRALIDOXIME (2-PAM)**

### **Description**

Pralidoxime is a cholinesterase reactivator

### **Pharmacology**

Pralidoxime dephosphorylates acetylcholinesterase that has been exposed to a cholinergic inhibitor as long as irreversible aging has not occurred. It reverses nicotinic effects, particularly on skeletal muscle. Muscarinic effects are also reversed, 2-PAM's effects are usually additive with atropine's.

### **Indications**

Cholinergic crisis due to acetylcholinesterase inhibition caused by nerve agent or organophosphate toxicity.

### **Onset/Duration**

Peak plasma oxime levels may be reached within 5-10 minutes. Duration of action may be 1 hour or longer.

### **Contraindications**

Pralidoxime is not indicated for cholinergic crisis caused by exposure to carbamate insecticides. It is also contraindicated for patients suffering from myasthenia gravis or renal failure.

### **Warnings**

Occasionally (usually as a result of rapid injection) may cause laryngospasm and muscle rigidity. Intubation may be required.

### **Drug Interactions**

None reported

### **Adverse Reactions**

Pralidoxime rarely causes dizziness, headache, blurred visions, nausea and diplopia (although these signs and symptoms may be related to the underlying poisoning as well).

### **Dosage and Routes of Administration**

Administer 1-2 grams over 5-10 minutes

## **PREDNISOLONE (PREDNISONE®)**

### **Description**

Prednisolone is a corticosteroid.

### **Pharmacology**

Prednisolone suppresses acute and chronic inflammation, potentiates vascular smooth muscle relaxation, and may alter airway hyperactivity.

### **Indications**

Prednisolone is indicated for bronchodilation and anaphylaxis.

### **Onset/Duration**

The onset of action may not occur for several hours if given PO; however, studies have shown that early administration is beneficial. The duration is 8 to 24 hours.

### **Contraindications**

Prednisolone is contraindicated for patients with a known hypersensitivity to prednisolone.

### **Warnings**

Prednisolone should be used with caution in patients with diabetes mellitus, as the hypoglycemic responses to insulin and oral hypoglycemic agents may be blunted. Potassium-depleting agents may potentiate hypokalemia induced by corticosteroids. Prednisolone should be used with caution in pregnant patients and patient with GI bleeding. Hold steroids for suspected pneumonia, CHF or "metabolic hyperventilation" (DKA, sepsis, etc.).

### **Drug Interactions**

See above warnings; prednisolone may also enhance or inhibit actions of anticoagulants.

### **Adverse Reactions**

Adverse reactions may include headache, hypertension, sodium and water retention, hypokalemia, alkalosis, and gastritis.

### **Dosage and Routes of Administration**

The recommended adult dosage is 60 mg PO for patients in mild to moderate respiratory distress secondary to asthma or COPD and for patients experiencing a moderate allergic reaction.

The recommended pediatric dose is 1 to 2 mg/kg PO for patients in mild to moderate respiratory distress secondary to asthma or COPD and for patients experiencing a moderate allergic reaction.

## **PROMETHAZINE (PHENERGAN®)**

### **Description**

Promethazine is a phenothiazine derivative and is considered an antihistamine and antiemetic.

### **Pharmacology**

Promethazine is a competitive H<sub>1</sub> receptor antagonist - it competitively blocks the histamine receptors but it doesn't block the release of histamine. Unlike neuroleptic phenothiazines, promethazine does not have dopamine antagonist properties and has no cardiovascular effects.

### **Indications**

Promethazine has sedative, antihistamine, antiemetic, and anticholinergic properties. It is administered to prevent and control nausea, vomiting, and motion sickness. It is also used as a sedative and to potentiate the effects of analgesics.

### **Onset/Duration**

Onset occurs within 5 minutes of IV injection and 20 minutes of IM injection. The duration of action is 4 to 6 hours.

### **Contraindications**

Promethazine is contraindicated for patients who have a sensitivity to promethazine or other phenothiazines, such as Compazine® or Thorazine®.

### **Warnings**

Extravasation of the medication into the surrounding tissues or administering SQ will cause pain and possible localized necrosis. Use caution when administering to elderly patients and patients with known seizure disorders or those taking anticonvulsant medications; promethazine may lower the seizure threshold.

### **Drug Interactions**

Additive sedative effects may result when administered with CNS depressants. Increased occurrence of extrapyramidal effects may result when administered with MAO inhibitors.

### **Adverse Reactions**

Promethazine may cause impairment of physical and mental abilities, drowsiness, extrapyramidal symptoms, akathisia, or a sensation of restlessness.

### **Dosage and Routes of Administration**

*If Ondansetron is unavailable:* As an antiemetic, the adult dosage is up to 12.5 mg via IV or deep IM, but older patients should receive a reduced dose of 6.25 mg.

Promethazine is not recommended for use in children younger than 2 years old. For children over two years, the recommended dose is half the adult dose; this also would require an order from medical control.

## **SODIUM BICARBONATE**

### **Description**

Sodium bicarbonate is a buffer.

### **Pharmacology**

Sodium bicarbonate reacts with hydrogen ions, forming water and carbon dioxide, correcting metabolic acidosis and increasing blood pH.

### **Indications**

Sodium bicarbonate is indicated in cardiac arrest only after more definitive treatment. It is also indicated in known acidosis, aspirin overdose and tricyclic antidepressant (TCA) overdose.

### **Onset/Duration**

The onset is 2-10 minutes with a duration of 30-60 minutes.

### **Contraindications**

Sodium bicarbonate is contraindicated in hypocalcemia, hypokalemia, alkalosis, and electrolyte loss due to vomiting and diarrhea.

### **Warnings**

Sodium bicarbonate administration may result in worsening of intracellular acidosis, hyperosmolality, hypernatremia, metabolic alkalosis, and acute hypokalemia.

### **Drug Interactions**

Sodium bicarbonate may precipitate with calcium. It may also deactivate vasopressors and may increase the half-life of some medications.

### **Adverse Reactions**

Adverse reactions may include metabolic alkalosis, hypoxia, electrolyte imbalance, and seizures.

### **Dosage and Routes of Administration**

The recommended adult and pediatric dose for metabolic acidosis is 1 mEq/kg IV, followed by a half-dose every 10 minutes as needed. Contact medical direction for orders and dosages.

## **SODIUM NITRITE**

### **Description**

Cyanide antidote; nitrite

### **Pharmacology**

Sodium nitrite oxidizes hemoglobin (Fe 2+) to form methemoglobin (Fe 3+). Methemoglobin preferentially binds with cyanide.

### **Indications**

Cyanide, cyanogenic and hydrogen sulfide toxicity

### **Onset/Duration**

Onset of action usually within minutes of administration. Duration is dose determinate.

### **Contraindications**

None in emergencies.

### **Warnings**

Be aware of: Hypotension- if the patient presents in a hypotensive crisis, consider skipping this step and proceeding to sodium thiosulfate. Pregnancy- Sodium nitrite crosses the placenta and can induce methemoglobinemia in the fetus. Monitor for excessive methemoglobinemia characterized by a progressive and persistent cyanosis unresponsive to oxygen therapy and a chocolate-brown color to the blood. Sodium nitrite may also precipitate an acute hemolytic reaction in patients with glucose-6-phosphodehydrogenase (G6PD) deficiency. May also cause excessive methemoglobinemia when given to carbon monoxide exposures.

### **Drug Interactions**

May potentiate methemoglobin formation when used with amyl nitrite

### **Adverse Reactions**

Adverse reactions may include: syncope, hypotension and the potential for excessive methemoglobinemia with decreased O2 saturations.

### **Dosage and Routes of Administration**

The adult dose is 300 mg IV (1 amp) over no less than 5 min. A repeat dose may be necessary if an adequate clinical response has not occurred in 30 minutes, administer 150 mg IV over no less than 5 min. Sodium nitrite may be diluted in 50-100 ml NSS and titrated to avoid hypotension.

## **SODIUM THIOSULFATE**

### **Description**

Sulfate forming compound.

### **Pharmacology**

Sodium thiosulfate provides sulfane sulfur. The hepatic enzyme rhodanese requires this to convert cyanide to thiocyanate which is then excreted in the urine.

### **Indications**

Suspected cyanide or cyanogenic poisoning with severe symptoms.

### **Onset/Duration**

Rapid onset, duration is dose determinate.

### **Contraindications**

None in acute cyanide toxicity.

### **Warnings**

May cause nausea and vomiting – be sure to maintain a patent airway.

### **Drug Interactions**

None reported

### **Adverse Reactions**

Hypotension is the chief adverse reaction.

### **Dosage and Routes of Administration**

The adult dose is 1 amp IV, (12.5 grams (50 ml of 25% solution)) slow over 10-20 minutes. Sodium thiosulfate may be diluted in 50-100 ml NSS and titrated to avoid hypotension

## **SUCCINYLCHOLINE (ANECTINE®)**

### **Description**

Succinylcholine is a depolarizing neuromuscular blocker.

### **Pharmacology**

Succinylcholine acts on the motor end plate receptors, producing depolarization, or fasciculations, and inhibiting subsequent neuromuscular transmission for the duration of the medication.

### **Indications**

Succinylcholine is indicated to facilitate endotracheal intubation.

### **Onset/Duration**

Succinylcholine has an onset of less than one minute and a very brief duration of action (less than five minutes), making it the drug of choice for drug-facilitated intubation.

### **Contraindications**

Succinylcholine is contraindicated in penetrating eye injury as it increases intraocular pressure. Succinylcholine is contraindicated in malignant hyperthermia as it may result in irreversible trismus. It is also contraindicated if the ability to control the airway and/or support ventilations is lacking.

### **Warnings**

Sedatives should be used in conjunction with succinylcholine administration. Premedication with atropine should be considered in pediatric patients. Premedication with lidocaine may blunt increased intracranial pressure associated with intubation.

### **Drug Interactions**

Oxytocin, beta blockers, oral contraceptives, some antibiotics, glucocorticoids, MAO inhibitors, and organophosphates may potentiate succinylcholine. Diazepam may decrease the duration of action.

### **Adverse Reactions**

Adverse reactions may include anaphylaxis, prolonged apnea, hypotension, hypertension, bradycardias, dysrhythmias, and fasciculations.

### **Dosage and Routes of Administration**

The adult dose by DFI protocol is 2 mg/kg rapid IV (maximum single dose of 200 mg), which requires a physician order.

The pediatric dose by DFI protocol is 2 mg/kg rapid IV (maximum single dose of 200 mg), which requires a physician order.

## **VECURONIUM BROMIDE (NORCURON®)**

### **Description**

Nondepolarizing neuromuscular blocking agent.

### **Pharmacology**

Vecuronium bromide is a short-acting (in comparison to other drugs in this classification), non depolarizing skeletal muscle relaxant that binds with the cholinergic receptor sites. That prevents acetylcholine from binding to receptors on motor end plate, thus blocking neuromuscular transmission and inhibiting transmission of nerve impulses, antagonizing the action of acetylcholine.

### **Indications**

To facilitate endotracheal intubation and to provide skeletal muscle relaxation during mechanical ventilation

### **Onset/Duration**

After IV infusion flaccid paralysis occurs within a few minutes (3-5) with maximum effect lasting from 30-60 minutes. The muscle paralysis caused by Vecuronium is sequential in the following order: first muscles affected include eyes, face and neck; followed by limbs, abdomen, chest with the diaphragm affected last. Recovery usually occurs in reverse order.

### **Contraindications**

Hypersensitivity reactions are possible. Serious but unlikely side effects include; aspiration, bradycardia, sinus arrest, hypertension, hypotension, increased intracranial pressure and malignant hyperthermia.

Various pre existing medical conditions may increase sensitivity to the drug such as; nerve-muscle conditions (e.g., myasthenia gravis, Eaton-Lambert syndrome), kidney or liver disorders, electrolyte imbalances (e.g., hypokalemia, hypermagnesemia, hypercalcemia), adrenal gland problems (e.g., Addison's disease). Cardiovascular disease, old age and edematous states result in increased volume of distribution and thus a delay in onset time- the dose should NOT be increased

### **Warnings**

Vecuronium has no known effect on consciousness, pain threshold or cerebration. Administration must be accompanied by adequate anesthesia or sedation. Causes respiratory paralysis; supportive airway control must be continuous and under direct monitoring at all times.

### **Drug Interactions**

Some antibiotics (e.g., aminoglycosides, tetracyclines, bacitracin, polymyxins, clindamycin), skeletal muscle relaxants (e.g., succinylcholine, pancuronium), calcium-channel blocking agents (e.g., verapamil), magnesium salts, and quinidine, may affect the neuromuscular blocking activity of vecuronium bromide.

### **Adverse Reactions**

Usually rare and related mostly to allergies caused by the drug.

### **Dosage and Routes of Administration**

Adult and pediatric: 0.1mg/kg slow administration (30-60 seconds) IV